PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-272688
(43)Date of publication of application : 24.09.2002

(51)Int.Cl. A61B 5/022
A61B 5/0245

(21)Application number : 2001-073940
(22)Date of filing : 15.03.2001

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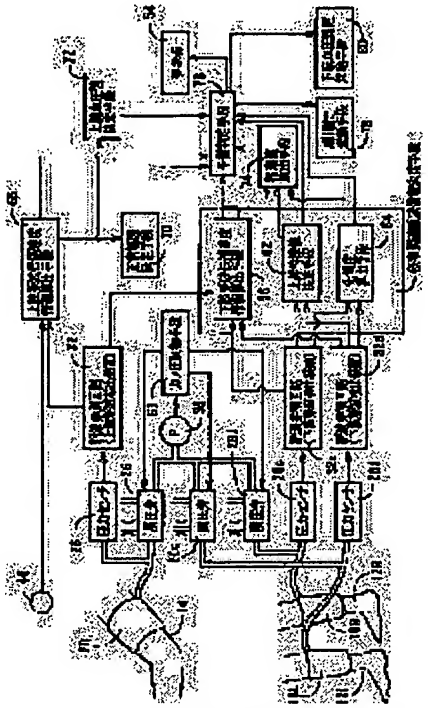
(54) ANKLE-BRACHIAL BLOOD PRESSURE INDEX MEASURING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an ankle-brachial blood pressure index measuring apparatus causing less paint to a patient in diagnosing an ankle artery for constriction.
SOLUTION: Before the pressure of an ankle cuff 18 is built up, for the measurement of blood pressure, to a pressure higher than the highest blood pressure value, the pressure of the ankle cuff 18 is built up to 60 mmHg and an ankle pulse wave WLL is detected. An ankle pulse wave propagation velocity information calculating means 68 calculates the propagation velocity baPWV of the ankle pulse wave on the basis of the ankle pulse wave WLL and a rise feature value determining means 62 calculates U-time. A sharpness calculating means 64 calculates %MAP, and using the baPWV, U-time, and %MAP a preliminary determination means 76 makes a preliminary determination as to whether or not the ankle artery is constricted. If the determination made by the preliminary determination means 76 shows no sign of constriction, then the need to measure the ankle blood pressure value using the ankle cuff 18 is eliminated, so the patient's pain is reduced.



LEGAL STATUS

[Date of request for examination] 15.03.2001
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Membrum-inferius blood-pressure-measurement equipment which is characterized by providing the following and which measures a membrum-inferius blood-pressure value which is a blood-pressure value in this membrum inferius using a cuff wound around a living body's membrum inferius, Upper extremity blood-pressure-measurement equipment which measures an upper extremity blood-pressure value which is a blood-pressure value in this upper extremity using a cuff wound around this living body's upper extremity, A membrum-inferius upper extremity blood-pressure characteristic measuring device equipped with a membrum-inferius upper extremity blood-pressure characteristic calculation means to compute a membrum-inferius upper extremity blood-pressure characteristic, based on a membrum-inferius blood-pressure value measured by this membrum-inferius blood-pressure-measurement equipment, and an upper extremity blood-pressure value measured by this upper extremity blood-pressure-measurement equipment Membrum-inferius pulse wave detection equipment with which this living body's membrum inferius is equipped and which detects a membrum-inferius pulse wave A constriction related pulse wave information decision means to determine constriction related pulse wave information changed in relation to a constriction of membrum inferius based on a membrum-inferius pulse wave detected by said membrum-inferius pulse wave detection equipment
[Claim 2] A preliminary judging means to judge with misgiving of a constriction being in an artery of lower extremity based on constriction related pulse wave information determined by said constriction related pulse wave information decision means being the value of abnormality within the limits set up beforehand, A membrum-inferius upper extremity blood-pressure characteristic measuring device according to claim 1 characterized by including further a blood-pressure-measurement starting means to perform blood pressure measurement with said membrum-inferius blood-pressure-measurement equipment and said upper extremity blood-pressure-measurement equipment when judged with there being misgiving of a constriction with this preliminary judging means.
[Claim 3] A membrum-inferius upper extremity blood-pressure characteristic measuring device according to claim 1 or 2 characterized by including at least one of the following three means as said constriction related pulse wave information decision means.
(1) the membrum inferius pulse wave velocity information calculation means (2) compute the membrum inferius pulse wave velocity information relevant to the speed a pulse wave spread said membrum inferius to speed based on the membrum inferius pulse wave detect by said membrum inferius pulse wave detection equipment -- the acutance of image calculation means (3) compute the acutance of image of the membrum inferius pulse wave detect by said membrum inferius pulse wave detection equipment -- the lifting feature value decision means determine the lifting feature value which be the feature value of the lifting portion of the membrum inferius pulse wave a pulse wave be detect by said membrum inferius pulse wave detection equipment [Claim 4] As said constriction related pulse wave information calculation means, it is based on a membrum-inferius pulse wave detected by said membrum-inferius pulse wave detection equipment. It is a membrum-inferius upper extremity blood-pressure characteristic measuring device including a membrum-inferius pulse-wave-velocity information calculation means to compute membrum-inferius pulse-wave-velocity information relevant to speed at which a pulse wave spreads said membrum inferius according to claim 1 or 2. Upper extremity pulse wave detection equipment with which said living body's upper extremity is equipped and which detects an upper extremity pulse wave, An upper extremity pulse-wave-velocity information calculation means to compute upper extremity pulse-wave-velocity information relevant to speed at which a pulse wave spreads said upper extremity based on an upper extremity pulse wave detected by this upper extremity pulse wave detection equipment, A normal-range decision means to determine a normal range of membrum-inferius pulse-wave-velocity information from relation memorized beforehand based on upper extremity pulse-wave-velocity information computed by this upper extremity pulse-wave-velocity information calculation means, Membrum-inferius pulse-wave-velocity information computed by said membrum-inferius pulse-wave-velocity information calculation means A membrum-inferius upper

extremity blood-pressure characteristic measuring device characterized by including further a preliminary judging means to judge with misgiving of a constriction being in an artery of lower extremity, based on being outside a normal range determined by said normal-range decision means.

[Claim 5] It is the membrum-inferius upper extremity blood-pressure characteristic measuring device which it is a membrum-inferius upper extremity blood-pressure characteristic measuring device according to claim 1 or 2, and membrum inferius of right and left of said living body is equipped with said membrum-inferius pulse wave detection equipment, respectively, and is characterized by said constriction related pulse wave information decision means being what determines said constriction related pulse wave information based on a left lower extremity pulse wave and a right lower extremity pulse wave, respectively.

[Claim 6] A membrum-inferius upper extremity blood-pressure characteristic measuring device according to claim 5 characterized by including a preliminary judging means to judge with misgiving of a constriction being in an artery of lower extremity in being beyond the reference value with which a difference value of constriction related pulse wave information based on a left lower extremity pulse wave determined in said constriction related pulse wave information decision means, respectively and constriction related pulse wave information based on a right lower extremity pulse wave was set up beforehand.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the membrum-inferius upper extremity blood-pressure characteristic measuring device which measures a membrum-inferius upper extremity blood-pressure characteristic.
[0002]
[Description of the Prior Art] Usually, the blood-pressure value (henceforth a membrum-inferius blood-pressure value) in the membrum inferius is higher than the blood-pressure value (henceforth an upper extremity blood-pressure value) in an upper extremity. However, if a constriction is in the artery of the membrum inferius, a membrum-inferius blood-pressure value will become lower than an upper extremity blood-pressure value. In order to diagnose the constriction of an artery of lower extremity using this, the membrum-inferius upper extremity blood-pressure characteristic measuring device which computes the membrum-inferius upper extremity blood-pressure characteristic which is the ratio of a membrum-inferius blood-pressure value and an upper extremity blood-pressure value is proposed. For example, the equipment indicated by the patent No. 3027750 official report is it.
[0003] In order to compute a membrum-inferius upper extremity blood-pressure characteristic, a membrum-inferius blood-pressure value and an upper extremity blood-pressure value must be measured. In order to measure a membrum-inferius blood-pressure value and an upper extremity blood-pressure value, generally the blood-pressure-measurement equipment of the format which measures a blood-pressure value based on the signal generated in a cuff in the process in which a living body's membrum inferius or upper extremity is made to carry out **** change of winding and the compression pressure force of the cuff for a cuff is used. The blood-pressure-measurement equipment of format using a cuff is because a reliable blood-pressure value is acquired. The membrum-inferius upper extremity blood-pressure characteristic computed based on the membrum-inferius blood-pressure value and upper extremity blood-pressure value which were measured using the cuff is reliable, and can diagnose the constriction of an artery of lower extremity with a sufficient precision.
[0004]
[Problem(s) to be Solved by the Invention] However, to measure a blood-pressure value with the blood-pressure-measurement equipment of format using a cuff, it is necessary to carry out pressure up of the compression pressure force of a cuff to the target preassure force once set as the pressure higher than a highest-blood-pressure value. Moreover, to measure a membrum-inferius blood-pressure value since the highest-blood-pressure value in the membrum inferius is higher than the highest-blood-pressure value in an upper extremity if it is a normal person, it is necessary to carry out pressure up of the compression pressure force of a cuff to the target preassure force still higher than the case where an upper extremity blood-pressure value is measured. For example, with membrum-inferius blood-pressure-measurement equipment, the target preassure force is set as a 240mmHg degree to the target preassure force having a common 180mmHg degree with upper extremity blood-pressure-measurement equipment. Therefore, when measuring a membrum-inferius blood-pressure value, there was a problem that the pain given to a patient was comparatively large.
[0005] The place which succeeded in this invention against the background of the above situation, and is made into the object has the pain of the patient at the time of diagnosing the constriction of an artery of lower extremity in offering few membrum-inferius upper extremity blood-pressure characteristic measuring devices.
[0006]
[Means for Solving the Problem] this invention person found out that there was information (let this be constriction related pulse wave information) changed in relation to a constriction of an artery of lower extremity also to information

acquired from a membrum-inferius pulse wave, as a result of repeating examination, in order to attain the above-mentioned object. And based on the constriction related pulse wave information, a preliminary diagnosis about a constriction of an artery of lower extremity was performed, and when it was suspected that a constriction is in an artery of lower extremity and a membrum-inferius upper extremity blood-pressure characteristic was computed, it resulted in an idea that pain of a patient at the time of diagnosing a constriction of an artery of lower extremity can be lessened. This invention is made based on starting thought.

[0007] Namely, invention concerning claim 1 for attaining said object Membrum-inferius blood-pressure-measurement equipment which measures a membrum-inferius blood-pressure value which is a blood-pressure value in the membrum inferius using a cuff wound around a living body's membrum inferius, Upper extremity blood-pressure-measurement equipment which measures an upper extremity blood-pressure value which is a blood-pressure value in the upper extremity using a cuff wound around the living body's upper extremity, It is based on a membrum-inferius blood-pressure value measured by the membrum-inferius blood-pressure-measurement equipment, and an upper extremity blood-pressure value measured by the upper extremity blood-pressure-measurement equipment. Membrum-inferius pulse wave detection equipment with which said living body's membrum inferius is equipped and which is a membrum-inferius upper extremity blood-pressure characteristic measuring device equipped with a membrum-inferius upper extremity blood-pressure characteristic calculation means to compute a membrum-inferius upper extremity blood-pressure characteristic, and detects a membrum-inferius pulse wave, It is characterized by including a constriction related pulse wave information decision means to determine constriction related pulse wave information changed in relation to a constriction of membrum inferius, based on a membrum-inferius pulse wave detected by the membrum-inferius pulse wave detection equipment.

[0008] In order to compute a membrum-inferius upper-extremity blood-pressure characteristic, it becomes unnecessary to perform blood pressure measurement by membrum-inferius blood-pressure-measurement equipment, when it can be judged from the constriction related pulse-wave information that there is no misgiving of a constriction of an artery of lower extremity, if constriction related pulse-wave information is determined from a membrum-inferius pulse wave which is detected by constriction related pulse wave information decision means with membrum-inferius pulse-wave detection equipment in advance of measurement of a membrum-inferius blood-pressure value by membrum-inferius blood-pressure-measurement equipment according to this invention. Therefore, pain of a patient at the time of diagnosing a constriction of an artery of lower extremity decreases. In addition, the above-mentioned decision may be judged automatically and people may judge it.

[0009] Moreover, invention concerning claim 2 for attaining said object A preliminary judging means to judge with misgiving of a constriction being in an artery of lower extremity based on constriction related pulse wave information determined by said constriction related pulse wave information decision means being the value of abnormality within the limits set up beforehand, When judged with there being misgiving of a constriction with the preliminary judging means, it is characterized by including further a blood-pressure-measurement starting means to perform blood pressure measurement with said membrum-inferius blood-pressure-measurement equipment and said upper extremity blood-pressure-measurement equipment.

[0010] When it is judged with there being misgiving of a constriction by preliminary judging means according to this invention, blood pressure measurement by membrum-inferius blood-pressure-measurement equipment and upper extremity blood-pressure-measurement equipment is automatically performed by blood-pressure-measurement starting means, and there is an advantage by which a membrum-inferius upper extremity blood-pressure characteristic is computed.

[0011] Moreover, invention concerning claim 3 for attaining said object is characterized by including at least one of the following three means as said constriction related pulse wave information decision means.

(1) the membrum-inferius pulse-wave-velocity information calculation means (2) compute the membrum-inferius pulse-wave-velocity information relevant to the speed at which a pulse wave spreads said membrum inferius based on the membrum-inferius pulse wave detected by said membrum-inferius pulse-wave detection equipment -- the acutance-of-image calculation means (3) compute the acutance of image of the membrum-inferius pulse wave detected by said membrum-inferius pulse-wave detection equipment -- the lifting feature value decision means [0012] determine the lifting feature value which is the feature value of the lifting portion of the membrum-inferius pulse wave detected by said membrum-inferius pulse-wave detection equipment Moreover, invention concerning claim 4 for attaining said object As said constriction related pulse wave information calculation means, it is based on a membrum-inferius pulse wave detected by said membrum-inferius pulse wave detection equipment. It is a membrum-inferius upper extremity blood-pressure characteristic measuring device including a membrum-inferius pulse-wave-velocity information calculation means to compute membrum-inferius pulse-wave-velocity information relevant to speed at which a pulse

wave spreads said membrum inferius according to claim 1 or 2. Upper extremity pulse wave detection equipment with which said living body's upper extremity is equipped and which detects an upper extremity pulse wave, An upper extremity pulse-wave-velocity information calculation means to compute upper extremity pulse-wave-velocity information relevant to speed at which a pulse wave spreads said upper extremity based on an upper extremity pulse wave detected by the upper extremity pulse wave detection equipment, A normal-range decision means to determine a normal range of membrum-inferius pulse-wave-velocity information from relation memorized beforehand based on upper extremity pulse-wave-velocity information computed by the upper extremity pulse-wave-velocity information calculation means, Membrum-inferius pulse-wave-velocity information computed by said membrum-inferius pulse-wave-velocity information calculation means is characterized by including further a preliminary judging means to judge with misgiving of a constriction being in an artery of lower extremity, based on being outside a normal range determined by said normal-range decision means.

[0013] According to this invention, a normal range of membrum-inferius pulse-wave-velocity information is determined from relation beforehand memorized by normal-range decision means based on upper extremity pulse-wave-velocity information. And it is judged with misgiving of a constriction being in an artery of lower extremity based on membrum-inferius pulse-wave-velocity information computed by membrum-inferius pulse-wave-velocity information calculation means being outside a normal range by preliminary judging means. Since the above-mentioned normal range is determined based on upper extremity pulse-wave-velocity information actually measured for every measurement, as compared with a case where misgiving of a constriction of an artery of lower extremity is judged based on whether it is in a general normal range set up so that membrum-inferius pulse-wave-velocity information measured actually might be applied to many patients, preliminary decision of existence of a constriction in an artery of lower extremity can perform it with a more sufficient precision.

[0014] Moreover, invention concerning claim 5 for attaining said object is a membrum-inferius upper extremity blood-pressure characteristic measuring device according to claim 1 or 2, membrum inferius of right and left of said living body is equipped with said membrum-inferius pulse wave detection equipment, respectively, and said constriction related pulse wave information decision means is characterized by being what determines said constriction related pulse wave information based on a left lower extremity pulse wave and a right lower extremity pulse wave, respectively.

[0015] According to this invention, by comparing constriction related pulse wave information based on a left lower extremity pulse wave with constriction related pulse wave information based on a right lower extremity pulse wave, when both difference is great, a constriction is in membrum inferius of one of right and left, and since it can judge that both difference may benefit that constriction large, preliminary diagnosis of existence of a constriction in an artery of lower extremity can carry out with a more sufficient precision.

[0016] Moreover, invention concerning claim 6 for attaining said object is a membrum-inferius upper-extremity blood-pressure characteristic measuring device according to claim 5, and when it is beyond the reference value with which the difference value of constriction related pulse-wave information based on a left lower extremity pulse wave determined in said constriction related pulse-wave information decision means, respectively and the constriction related pulse-wave information based on a right lower extremity pulse wave was set up beforehand, it is characterized by to include a preliminary judging means judge with the misgiving of a constriction being in an artery of lower extremity.

[0017] Since according to this invention it is judged with there being misgiving of a constriction by preliminary judging means when a difference value of constriction related pulse wave information based on a left lower extremity pulse wave and constriction related pulse wave information based on a right lower extremity pulse wave is beyond a reference value, preliminary decision of existence of a constriction in an artery of lower extremity can carry out with a more sufficient precision.

[0018]

[A gestalt of suitable implementation of invention] Hereafter, 1 operation gestalt of this invention is explained to details based on a drawing. Drawing 1 is a block diagram explaining a configuration of the ankle overarm blood-pressure characteristic measuring device 10 with which this invention was applied. That is, the ankle overarm blood-pressure characteristic measuring device 10 of drawing 1 is a membrum-inferius upper extremity blood-pressure characteristic measuring device with which an ankle 12 (right ankle 12R and left ankle 12L) was chosen as membrum inferius, and an overarm 14 (right upper arm 14R and left upper arm 14L) was chosen as an upper extremity. in addition, measurement by this ankle overarm blood-pressure characteristic measuring device 10 -- an overarm 14 and an ankle 12 -- abbreviation -- a patient 16 is measured at least for proneness in the state of either - lateral position and a lateral position so that it may become the same height.

[0019] The cuffs 18R and 18L for ankles are wound around Ankles 12R and 12L, respectively, and the cuffs 20R and 20L for overarms are wound around Overarms 14R and 14L, respectively. These cuffs 18 and 20 are tourniquet which

presses a part currently wound, and have rubber bag-making in a bag outside band-like which consists of a raw material without the extensibility of cloth or polyester.
[0020] The cuffs 20R and 20L for overarms are connected to main part of blood-pressure-measurement equipment 24a, and b through Piping 22a and 22b, respectively, and the cuffs 18R and 18L for ankles are connected to main part of blood-pressure-measurement equipment 24c, and d through piping 22c and d, respectively.
[0021] Since these four main part of blood-pressure-measurement equipment 24a, and b, c and d have the same configuration, they explain a configuration of the main part 24 of blood-pressure-measurement equipment by making into an example main part of blood-pressure-measurement equipment 24b connected with cuff 20L for overarms. Main part of blood-pressure-measurement equipment 24b is equipped with pressure regulating valve 26b, pressure-sensor 28b, static pressure discriminator 30b, and pulse wave discriminator 32b, and said piping 22b is connected to pressure-sensor 28b and pressure regulating valve 26b. Moreover, pressure regulating valve 26b is connected to an air pump 36 through piping 34.
[0022] A pressure supply condition of permitting the above-mentioned pressure regulating valve 26b supplying pressure air generated by air pump 36 into cuff 20L for overarms, A pressure maintenance condition of maintaining a pressure in cuff 20L for overarms, a **** exhaust-gas-pressure condition which carries out exhaust gas pressure of the pressure in cuff 20L for overarms gradually at the rate of predetermined by controlling an opening of an electric bulb, And it changes to four conditions of a rapid exhaust-gas-pressure condition which carries out exhaust gas pressure of the inside of cuff 20L for overarms quickly.
[0023] Pressure-sensor 28b supplies the pressure signal SPb with which a pressure in cuff 20L for overarms is detected, and the pressure is expressed, respectively to static pressure discriminator 30b and pulse wave discriminator 32b. Static pressure discriminator 30b is equipped with a low pass filter, and supplies it to an arithmetic sequence unit 38 through an A/D converter which discriminates from the cuff pressure signal SKb showing steady pressure PCb, i.e., cuff pressure, contained in the pressure signal SPb, and does not illustrate the cuff pressure signal SKb.
[0024] Pulse wave discriminator 32b is equipped with a band pass filter, and supplies it to an arithmetic sequence unit 38 through an A/D converter which discriminates from the pulse wave signal SMb which is the oscillating component of the pressure signal SPb in frequency, and does not illustrate the pulse wave signal SMb. Since this pulse wave signal SMb expresses the overarm pulse wave WAL from an artery of left upper arm 14L pressed by cuff 20L for overarms, pulse wave discriminator 32b is functioning as upper extremity pulse wave detection equipment. Similarly moreover, pulse wave discriminator 32of main part of blood-pressure-measurement equipment 24a a It functions as upper extremity pulse wave detection equipment which discriminates from the pulse wave signal SMa showing the overarm pulse wave WAR from an artery of right upper arm 14R. Pulse wave discriminator 32of main part of blood-pressure-measurement equipment 24c c It functions as membrum-inferius pulse wave detection equipment which discriminates from the pulse wave signal SMc showing the ankle pulse wave WLR from an artery of right ankle 12R. 32d of pulse wave discriminators of 24d of main parts of blood-pressure-measurement equipment It functions as membrum-inferius pulse wave detection equipment which discriminates from the pulse wave signal SMd showing the ankle pulse wave WLL from an artery of left ankle 12L.
[0025] In addition, overarm blood-pressure-measurement equipment 40L is constituted by cuff 20for overarms L, main part of blood-pressure-measurement equipment 24b, and air pump 36. Similarly, overarm blood-pressure-measurement equipment 40R is constituted by cuff 20for overarms R, main part of blood-pressure-measurement equipment 24a, and air pump 36, ankle blood-pressure-measurement equipment 42R is constituted by cuff 18for ankles R, main part of blood-pressure-measurement equipment 24c, and air pump 36, and ankle blood-pressure-measurement equipment 42L is constituted by cuff 18for ankles L, 24d of main parts of blood-pressure-measurement equipment, and air pump 36.
[0026] A predetermined part on a living body's thorax epidermis is equipped with the heartbeat microphone 44, and it detects and outputs the cardiac correspondence number SH showing a heartbeat. The cardiac correspondence number SH outputted from the heartbeat microphone 44 is supplied to an arithmetic sequence unit 38 through A/D converter 46. Since a heartbeat which the above-mentioned cardiac correspondence number SH expresses is a heartbeat synchronizing signal generated synchronizing with a living body's heartbeat, the heartbeat microphone 44 which outputs the cardiac correspondence number SH is functioning as heartbeat synchronizing signal detection equipment.
[0027] The above-mentioned arithmetic sequence unit 38 consists of so-called microcomputers equipped with CPU48, ROM50, RAM52, an I/O Port that is not illustrated. CPU48 By performing signal processing, using a memory storage function of RAM52 for ROM50 according to a program memorized beforehand While outputting a driving signal from an I/O Port and controlling the pressure regulating valve 26 within an air pump 36 and the main part 24 of blood-pressure-measurement equipment Calculation of an ankle overarm blood-pressure characteristic (Ankle/Arm Blood Pressure =ABI) etc. is performed, and the computed ABI is displayed on a drop 54.

[0028] It is a functional block diagram explaining an important section of a function about a preliminary diagnosis for judging whether there is any misgiving of a constriction, so that drawing 2 needs measurement of ABI among control functions of the above-mentioned arithmetic sequence unit 38.
[0029] The cuff pressure control means 60 is set to blood pressure measurement. Four pressure regulating valve 26a connected to an air pump 36 and it, and b, c and d are controlled. The cuff pressures PCa, PCb, PCc, and PCd of the cuff 20 for overarms, and the cuff 18 for ankles To the predetermined target preassure force value PCM (about a 180mmHg degree and the cuff 18 for ankles, it is [cuff / 20 / for overarms] the pressure value of a 240mmHg degree), rapid pressure up is carried out and **** pressure lowering is carried out at the rate of 5 mmHg/sec degree after that. Moreover, after controlling four pressure regulating valve 26a connected to an air pump 36 and it, and b, c and d and carrying out pressure up of the cuff pressures PCa, PCb, PCc, and PCd to predetermined pulse wave ******, the pressure is made to hold fixed time in detection of a pulse wave for computing constriction related pulse wave information. The above-mentioned pulse wave ****** is the pressure which is generated in signal strength with a pulse wave it is lower than a general lowest-blood-pressure value, and sufficient which a pressure oscillatory wave generated in an artery under the cuff in cuffs 18 and 20 is transmitted, and expresses the pressure oscillatory wave to cuffs 18 and 20, for example, is 60mmHg(s).
[0030] the lifting feature value decision means 62 determines the lifting feature value which expresses the feature of a lifting portion of the left ankle pulse wave WLL extracted by the right ankle pulse wave WLR and 32d of pulse wave discriminators extracted by pulse wave discriminator 32c in the condition that the cuff 18 for ankles is maintained by said pulse wave ****** by the cuff pressure control means 60 from a point to a peak namely, -- starting, respectively. Drawing 3 is drawing which illustrates the ankle pulse wave WL, and what is shown in drawing 3 is contained in the lifting feature value. namely, inclination [of the tangent L in U-time (msec) computed as a period when it starts at and the ankle pulse wave WL from Point a to Peak b goes up, and the point c, i.e., the point inclining, that start and the rate of increase serves as max even at a peak b from a point a] gamma -- it starts and a ratio with time amount etc. is contained in a lifting feature value time amount and the second half the first-half time amount from a point a to the point c inclining, the second-half time amount from Since the ankle pulse wave WLR and WLL are in an inclination to start and for dip of a portion to become gently-sloping so that a degree of a constriction in membrum inferius of the upstream of Ankles 12R and 12L is large, if a constriction is in membrum inferius of the upstream of Ankles 12R and 12L, the lifting feature value will change in relation to the constriction. For example, U-time becomes so long that a degree of a constriction in the upstream is large. Therefore, the lifting feature value computed from the ankle pulse wave WLR and WLL is constriction related pulse wave information, and the lifting feature value decision means 62 functions as a constriction related pulse wave information decision means.
[0031] The acutance-of-image calculation means 64 computes acutance of image of the left ankle pulse wave WLL extracted by the right ankle pulse wave WLR and 32d of pulse wave discriminators extracted by pulse wave discriminator 32c in the condition that the cuff 18 for ankles is maintained by said pulse wave ****** by the cuff pressure control means 60, respectively. The above-mentioned acutance of image is a value to the upper part of a pulse wave which sharpens and shows condition. For example By breaking the pulse wave area S computed by integrating with the ankle pulse wave WL of the section for one beat shown in drawing 3 (addition) by product (WxH) of peak height H and the pulse period W namely, S/(WxH) -- the normalization pulse wave area VR computed by performing an operation -- I/W which normalized the width-of-face size I of what normalized the area S1 of the first portion to the highest peak b or the area S2 of the second half section after the highest peak b, and height equivalent to Hx (2/3) is acutance of image. Moreover, the above-mentioned normalization pulse wave area VR is also called %MAP, and can be computed also as a rate (= 100xH/G) of peak height H, i.e., height G of a center-of-gravity location of the pulse wave area S to pulse pressure. an ankle 12 -- if a constriction is in membrum inferius of the upstream of R and L -- amplitude of the ankle pulse wave WLR and WLL -- weak -- becoming -- the upper part of a pulse wave -- it sharpens and condition becomes blunt. That is, if a constriction is in membrum inferius of the upstream of Ankles 12R and 12L, since the above-mentioned acutance of image will become small, acutance of image computed from the ankle pulse wave WLR and WLL is constriction related pulse wave information, and the acutance-of-image calculation means 64 functions as a constriction related pulse wave information decision means.
[0032] The upper extremity pulse-wave-velocity information calculation means 66 computes upper extremity pulse-wave-velocity information relevant to speed at which a pulse wave spreads between predetermined 2 parts containing an upper extremity (however, membrum inferius is not included). The two above-mentioned part is a part and the heart which are equipped with the cuff 20 for overarms. Moreover, upper extremity pulse wave velocity which is the speed at which a pulse wave spreads the upper extremity pulse wave propagation time which is the time amount to which a pulse wave spreads an upper extremity, and an upper extremity is contained in upper extremity pulse-wave-velocity

information. In considering as a part and the heart with which the cuff 20 for overarms is equipped with the two above-mentioned part For example, an event of predetermined parts (start point of I sound etc.) of a heartbeat detected with the heartbeat microphone 44 repeated periodically occurring, Time difference with an event of predetermined parts (starting point etc.) of the overarm pulse wave WA extracted by the pulse wave discriminator 32 which functions as upper extremity pulse wave detection equipment repeated periodically occurring is computed as the upper extremity pulse wave propagation time hbDT (sec). Or the upper extremity pulse wave velocity hbPWV (cm/sec) is computed from the formula 1 beforehand memorized by ROM50 based on the upper extremity pulse wave propagation time hbDT. In addition, in a formula 1, L1 (cm) is the distance to a part where it is equipped with the cuff 20 for overarms through a main artery from an aortic valve, and constant value beforehand determined based on an experiment is used.
(Formula 1) hbPWV = L1-/hbDT [0033] The membrum-inferius pulse-wave-velocity information calculation means 68 computes membrum-inferius pulse-wave-velocity information relevant to speed at which a pulse wave spreads between predetermined 2 parts containing membrum inferius. The two above-mentioned part is a part where it is equipped with the cuffs 18R or 18L for the heart and ankles. Moreover, the membrum-inferius pulse wave propagation time and membrum-inferius pulse wave velocity are contained in membrum-inferius pulse-wave-velocity information like upper extremity pulse-wave-velocity information. If a constriction is in membrum inferius between the above-mentioned 2 parts, since the membrum-inferius pulse wave propagation time will become long and membrum-inferius pulse wave velocity will become slow, membrum-inferius pulse-wave-velocity information is constriction related pulse wave information, and the membrum-inferius pulse-wave-velocity information calculation means 68 functions as a constriction related pulse wave information decision means. In considering as a part where the cuff 18 for the heart and ankles is equipped with the two above-mentioned part For example, an event of predetermined parts (start point of I sound etc.) of a heartbeat detected with the heartbeat microphone 44 repeated periodically occurring, Time difference with an event of the ankle pulse wave WLR extracted by the pulse wave discriminators 32c and 32d which function as membrum-inferius pulse wave detection equipment, and predetermined parts (starting point etc.) of WLL repeated periodically occurring is computed as the membrum-inferius pulse wave propagation time baDT (sec). The membrum-inferius pulse wave velocity baPWV (cm/sec) is computed from the formula 2 beforehand memorized by ROM50 based on the membrum-inferius pulse wave propagation time baDT. In addition, in a formula 2, L2 (cm) is the distance to a part where it is equipped with the cuff 18 for ankles from an aortic valve, and constant value beforehand determined based on an experiment is used.
(Formula 2) baPWV = L2-/baDT [0034] The normal-range decision means 70 determines a normal range of membrum-inferius pulse-wave-velocity information based on upper extremity pulse-wave-velocity information computed by the upper extremity pulse-wave-velocity information calculation means 66 from relation beforehand memorized between upper extremity pulse-wave-velocity information and membrum-inferius pulse-wave-velocity information. upper extremity pulse-wave-velocity information actually computed by the upper extremity pulse-wave-velocity information calculation means 68, having assumed that there was no constriction in an upper extremity since fixed proportionality was materialized between upper extremity pulse-wave-velocity information and membrum-inferius pulse-wave-velocity information when there was no constriction in an upper extremity and membrum inferius -- using -- an account of a top -- the above-mentioned normal range is determined from proportionality memorized beforehand. Drawing 4 is drawing which illustrates relation between the membrum-inferius pulse wave velocity baPWV computed between the upper extremity pulse wave velocity hbPWV, the hearts, and ankles which were computed between the heart and an overarm. When using relation shown in drawing 4 as relation memorized beforehand, the range of -10%-+10% of the membrum-inferius pulse wave velocity baPWV is determined as a normal range focusing on the membrum-inferius pulse wave velocity baPWV determined from the upper extremity pulse wave velocity hbPWV. In addition, in drawing 4 , pulse wave velocity PWV depends a thing with the membrum-inferius pulse wave velocity baPWV quicker than the upper extremity pulse wave velocity hbPWV on becoming quick in inverse proportion to 1/square of a diameter of a blood vessel, and the ankle of a diameter of a blood vessel being thinner than an overarm.
[0035] In a process in which the cuff 20 for overarms is made to carry out **** pressure lowering of the overarm blood-pressure value decision means 72 by the cuff pressure control means 60 An oscillometric method which was easy to be based on change of amplitude of the overarm pulse waves WAR and WAL which the pulse wave signals SMa or SMb by which sequential extraction is carried out express, and was known is used. the right upper arm highest-blood-pressure value BPASYS which is the blood-pressure value BP of right upper arm 14R -- (R), right upper arm lowest-blood-pressure value BPADIA(R), and the right upper arm mean-blood-pressure value BPAMEAN (R) -- (L), left upper arm lowest-blood-pressure value BPADIA(L), and the left upper arm mean-blood-pressure value BPAMEAN (L) are determined. and the left upper arm highest-blood-pressure value BPASYS which is the blood-pressure value BP in left upper arm 14L -- The determined right upper arm highest-blood-pressure value BPASYS(R) left upper arm highest-

blood-pressure value BPASYS (L) is displayed on a drop 54.
[0036] The difference value calculation means 74 computes a difference value of pulse-wave-velocity information on a left lower extremity and pulse-wave-velocity information on a right lower extremity which were computed by the membrum-inferius pulse-wave-velocity information calculation means 68, a difference value of the lifting feature value of a left lower extremity and the lifting feature value of a right lower extremity which were determined by the lifting feature value decision means 62, and a difference value of acutance of image of a left lower extremity and acutance of image of a right lower extremity which were computed by the acutance-of-image calculation means 64. The above-mentioned difference value is a value which shows how much constriction related pulse wave information, such as pulse-wave-velocity information, differs by right and left, for example, is a difference or a ratio on either side etc.
[0037] It judges with a preliminary judging means 76 having the misgiving of a constriction in an artery of lower extremity based on being the value of abnormality within the limits set up as a range where membrum-inferius pulse-wave-velocity information computed, respectively by the membrum-inferius pulse-wave-velocity information calculation means 68 which is a constriction related pulse-wave information decision means, the lifting feature value decision means 62, and the acutance-of-image calculation means 64, the lifting feature value, and acutance of image have the misgiving of a constriction about each.
[0038] The abnormality range of the above-mentioned membrum-inferius pulse-wave-velocity information is a range outside a normal range determined with said normal-range decision means 70. Moreover, the abnormality range of the lifting feature value and the abnormality range of acutance of image are beforehand determined based on an experiment. When U-time is computed as a lifting feature value, an abnormality range is set as 180 or more msecs, and when %MAP is computed as acutance of image, an abnormality range is set up to 42% or less. Moreover, when at least one of three of the above-mentioned membrum-inferius pulse-wave-velocity information, the lifting feature value, and acutance of image is an abnormality range, you may judge with misgiving of a constriction being in an artery of lower extremity, and when any two are an abnormality range, or when all three are an abnormality range, you may judge with misgiving of a constriction being in an artery of lower extremity. In addition, since membrum-inferius pulse-wave-velocity information, the lifting feature value, and acutance of image are determined about membrum inferius on either side, respectively, misgiving of a constriction of an artery of lower extremity can be judged about each membrum inferius on either side.
[0039] It judges with the preliminary judging means 76 having the misgiving of a constriction in an artery of lower extremity based on being beyond the reference value with which membrum-inferius pulse-wave-velocity information computed with said difference value calculation means 72, the lifting feature value, and a difference value of acutance of image were set up further beforehand. A difference value turns into beyond a reference value because it thinks because a constriction is in either of the membrum inferius on either side. in addition -- a case where it judges with misgiving of a constriction being in an artery of lower extremity based on a difference value -- right and left -- whether misgiving of a constriction is in which membrum inferius cannot judge.
[0040] It judges whether the preliminary judging means 76 is smaller than the minimum value (for example, 100mmHg (s)) to which no above-mentioned membrum-inferius pulse-wave-velocity information, lifting feature values, and acutance of image were abnormality ranges, and the overarm highest-blood-pressure value BPASYS further determined by the overarm blood-pressure value decision means 72 was beforehand set when said difference value was smaller than a reference value. Thus, it is because it is difficult to diagnose a constriction of an artery of lower extremity even if judging whether the overarm highest-blood-pressure value BPASYS is smaller than the minimum value set up beforehand computes ABI, when the overarm highest-blood-pressure value BPASYS is smaller than the minimum value set up beforehand, a constriction is in an upper extremity, the overarm highest-blood-pressure value BPASYS may be falling and there is a constriction also in an upper extremity.
[0041] When it is the case where it is judged with an ABI measurement starting means 78 to function as a blood-pressure-measurement starting means having the misgiving of a constriction in an artery of lower extremity with the preliminary judging means 76 and the overarm highest-blood-pressure value BPASYS is said more than minimum value, the overarm blood-pressure value decision means 72 and an ankle blood-pressure value decision means 82 to mention later are performed. In addition, when there is misgiving of a constriction only in one membrum inferius, blood pressure measurement is performed only about the ankle 12 of a side which has misgiving of a constriction with the ankle blood-pressure value decision means 82. Moreover, although while was beforehand set up also about overarm blood pressure measurement by the overarm blood-pressure value decision means 72 and blood pressure measurement may be performed only about an overarm 14, blood pressure measurement is preferably performed about the overarm 14 of both sides.
[0042] It is the case where it is judged with the membrum-inferius blood-pressure-measurement starting means 80

having the misgiving of a constriction in an artery of lower extremity with the preliminary judging means 76, and when the overarm blood-pressure value BPASYS is smaller than said minimum value, the ankle blood-pressure value decision means 82 is performed. Since it is difficult to diagnose a constriction of an artery of lower extremity from ABI when the overarm blood-pressure value BPASYS is smaller than said minimum value, it is for diagnosing a constriction of an artery of lower extremity only with an absolute value of the ankle blood-pressure value BQL.

[0043] It is a functional block diagram explaining an important section of a function performed when judged with drawing 5 having the misgiving of a constriction in an artery of lower extremity by performing a function shown in drawing 2 among control functions of an arithmetic sequence unit 38.

[0044] The ankle blood-pressure value decision means 82 is performed by the ABI measurement starting means 78 or the membrum-inferius blood-pressure-measurement starting means 80. In a process which make control compression pressure force of the cuff 18 for ankles wound around the ankle 12 of membrum inferius of a certain one side of misgiving of a constriction, or both by the cuff pressure control means 60, and compression pressure force of the cuff 18 for ankles is made to carry out **** pressure lowering An oscillometric method which was easy to be based on change of amplitude of the membrum-inferius pulse waves WLR and WLL which the pulse wave signals SMC or SMd by which sequential extraction is carried out express, and was known is used. The right ankle highest-blood-pressure value BPLSYS (R) which is the blood-pressure value BP in right ankle 12R, right ankle lowest-blood-pressure value BPLDIA (R) and a right ankle mean-blood-pressure value BPLMEAN (R) And the left ankle highest-blood-pressure value BPLSYS (L) which is the blood-pressure value BP in left ankle 12L, and left ankle lowest-blood-pressure value BPLDIA(L) and a left ankle mean-blood-pressure value BPLMEAN (L) are determined. The determined right ankle highest-blood-pressure value BPLSYS(R) left ankle highest-blood-pressure value BPLSYS (L) is displayed on a drop 54.

[0045] An ankle overarm blood-pressure characteristic calculation means 84 to function as a membrum-inferius upper extremity blood-pressure characteristic calculation means The right ankle blood-pressure value blood-pressure value BQL (R) (for example, the right ankle highest-blood-pressure value BPLSYS (R)) determined by the ankle blood-pressure value decision means 82, or the left ankle blood-pressure value BQL (L) (for example, the left ankle highest-blood-pressure value BPLSYS (L)) By breaking by the overarm blood-pressure value BPA (for example, the overarm highest-blood-pressure value BPASYS being equivalent to the ankle highest-blood-pressure value BPLSYS) corresponding to the above-mentioned ankle blood-pressure value BQL among the overarm blood-pressure values BPA determined by the overarm blood-pressure value decision means 72 A right ankle overarm blood-pressure characteristic (= ABIR) or a left ankle overarm blood-pressure characteristic (= ABIL) is computed. And a value of the computed ABIR and ABIL is displayed on a drop 54.

[0046] Since the right ankle blood-pressure value BQL (R) and the left ankle blood-pressure value BQL (L) fall when there is a constriction of an artery of lower extremity, as for these ABIR(s) and ABIL, a constriction of an artery of lower extremity falls to a case. Therefore, when ABIR and ABIL are smaller than a reference value (for example, 0.9), it can be judged that misgiving to which a constriction is in an artery of lower extremity is strong. In addition, any shall be used as an overarm blood-pressure value BPA in calculation of ABI between the right upper arm blood-pressure value BQL (L) and the left upper arm blood-pressure value BPA (L) uses a value of the higher one preferably, although it may be beforehand determined in advance of blood pressure measurement. It is because ABI will become small if a value of the higher one is used, so it becomes easy to discover a constriction of an artery of lower extremity based on ABI.

[0047] Drawing 6 thru/or drawing 9 are the flow charts for explaining still more concretely an important section of a control function of the arithmetic sequence unit 38 shown in drawing 2 and drawing 5 , drawing 6 is a signal reading routine which reads a signal for a preliminary judging, drawing 7 is a preliminary judging routine which performs a preliminary judging based on the read signal, drawing 8 is an ABI measurement routine, and drawing 9 is an ankle blood-pressure-measurement routine.

[0048] First, a signal reading routine of drawing 6 is explained. At the step (a step is skipped hereafter) SA 1 of drawing 6 When main part of blood-pressure-measurement equipment 24a, pressure regulating valve 26a with which b, c, and d are equipped, respectively, and b, c and d are made into a pressure supply condition and an air pump 36 drives Pressure up of the cuffs 18R and 18L for ankles and the cuffs 20R and 20L for overarms is started, and it is judged in continuing SA2 whether cuff pressure PC of four cuffs 18R, 18L, 20R, and 20L was set to 60 or more mmHgs set up as pulse wave ******. When decision of this SA2 is denied, decision of SA2 is repeated.

[0049] And if decision of the above SA 2 is affirmed by lifting of cuff pressure PC, in continuing SA3, cuff pressure PC will be maintained by suspending an air pump 36 and changing a pressure regulating valve 26 to a pressure maintenance condition. The above [SA / SA and / 3] 1 is equivalent to the cuff pressure control means 60.

[0050] In continuing SA4, the cardiac correspondence number SH supplied from the pulse wave signals SMb, SMc, and

SMd and the heartbeat microphone 44 which are supplied from main part of blood-pressure-measurement equipment 24b, pulse wave discriminator 32b with which c and d are equipped, respectively, and c and d is read by one beat.
[0051] Then, SA5 thru/or SA8 equivalent to the cuff pressure control means 60 is performed. SA5 -- a pressure regulating valve 26 -- c and d are changed to a rapid exhaust-gas-pressure condition -- the cuff 18 for ankles -- when the cuff pressures PCc and PCd of R and L are released, and pressure regulating valves 26a and 26b are again switched to a pressure supply condition in continuing SA6 and an air pump 36 drives again, rapid pressure up of the cuffs 20R and 20L for overarms is started. In continuing SA7, it is judged whether it became more than the aim [for the cuff pressures PCa and PCb of the cuffs 20R and 20L for overarms to have been set as 180mmHg(s), respectively] compression pressure PCM. When decision of this SA7 is denied, lifting of cuff pressures PCa and PCb is continued by carrying out repeat activation of six or less above SA.
[0052] And if decision of the above SA 7 is affirmed by lifting of cuff pressures PCa and PCb, at continuing SA8, an air pump 36 will be suspended, and pressure regulating valves 26a and 26b will be switched to a **** exhaust-gas-pressure condition, and it will be dropped at a loose speed which is a 5 mmHg/sec degree as which a pressure in cuff 20for overarms R and 20L was determined beforehand.
[0053] Next, a blood-pressure value decision routine of SA9 equivalent to the overarm blood-pressure value decision means 72 is performed. That is, amplitude of the overarm pulse waves WAR and WAL which the pulse wave signals SMa and SMb serially supplied from the pulse wave discriminators 32a and 32b express is determined for every beat, and the right upper arm highest-blood-pressure value BPASYS (R), the left upper arm neck highest-blood-pressure value BPASYS (L), etc. are determined according to blood-pressure value decision algorithm of an oscillograph metric method known well based on change of the amplitude.
[0054] Then, in SA10 equivalent to the cuff pressure control means 60, by switching two pressure regulating valves 26a and 26b to a rapid exhaust-gas-pressure condition, the inside of cuff 20for overarms R and 20L is made to carry out exhaust gas pressure quickly, and a signal reading routine is terminated.
[0055] After a signal reading routine is terminated, a preliminary judging routine of drawing 7 is performed continuously. In drawing 7 , SB1 which is equivalent to the upper extremity pulse-wave-velocity information calculation means 66 first is performed. While a start point of I sound of a heartbeat is determined in SB1 based on the cardiac correspondence number SH read by SA4 of drawing 6 A standup point of the left upper arm pulse wave WAL which the pulse wave signal SMb expresses based on the pulse wave signal SMb read by the SA4 is determined. The time difference hbDT of a start point of I sound and a standup point of the left upper arm pulse wave WAL, i.e., the upper extremity pulse wave propagation time, is computed, and the upper extremity pulse wave velocity hbPWV is further computed by the upper extremity pulse wave propagation time HbDT being substituted for said formula 1.
[0056] Then, SB2 equivalent to the normal-range decision means 70 is performed. In SB2, based on the upper extremity pulse wave velocity hbPWV computed by the above SB 1, the membrum-inferius pulse wave velocity baPWV is determined from relation of above-mentioned drawing 4 , and -10% to +10% of range of the determined membrum-inferius pulse wave velocity baPWV is determined as a normal range of the membrum-inferius pulse wave velocity hbPWV.
[0057] Then, the right lower extremity pulse wave velocity baPWV (R) and the left lower extremity pulse wave velocity baPWV (L) are computed by SB3 equivalent to the membrum-inferius pulse-wave-velocity information calculation means 68 being performed. Namely, a standup point of the right ankle pulse wave WLR which the pulse wave signals SMc and SMd express based on the pulse wave signals SMc and SMd read by SA4 of drawing 6 , respectively, and the left ankle pulse wave WLL is determined, respectively. Then, time difference (R) baDT, i.e., the right lower extremity pulse wave propagation time, of a standup point of the left upper arm pulse wave WAL and a standup point of the above-mentioned right ankle pulse wave WLR which were determined by said SB1 And the time difference (L) baDT of a standup point of the left upper arm pulse wave WAL and a standup point of the above-mentioned left ankle pulse wave WLL which were determined by said SB1, i.e., the left lower extremity pulse wave propagation time, is computed. Furthermore, the right lower extremity pulse wave velocity baPWV (R) and the left lower extremity pulse wave velocity baPWV (L) are computed by these right lower extremity pulse wave propagation time baDT (R) and the left lower extremity pulse wave propagation time baDT (L) being substituted for said formula 2. Moreover, the computed right lower extremity pulse wave velocity baPWV (R) and the left lower extremity pulse wave velocity baPWV (L) are displayed on a drop 54.
[0058] Then, SB4 equivalent to the lifting feature value decision means 62 is performed. A standup point and a peak of the right ankle pulse wave WLR which the pulse wave signals SMc and SMd express with SB4 based on the pulse wave signals SMc and SMd read by SA4 of drawing 6 , respectively, and the left ankle pulse wave WLL are determined. It starts with a peak of the right ankle pulse wave WLR, and time difference with a point is computed as U-time (R), it

starts with a peak of the left ankle pulse wave WLL, and time difference with a point is computed as U-time (L). Moreover, U-time (R) and U-time (R) which were computed are displayed on a drop 54.
[0059] Then, SB5 equivalent to the acutance-of-image calculation means 64 is performed. While %MAP (R) is computed by breaking the area S by product (WxH) of peak height H and the pulse period W about the right ankle pulse wave WLR which the pulse wave signal SMc read by SA4 of drawing 6 expresses with SB5 About the left ankle pulse wave WLL which the pulse wave signal SMd read by SA4 of drawing 6 expresses, %MAP (L) is computed by breaking the area S by product (WxH) of peak height H and the pulse period W. Moreover, %MAP (R) and %MAP (L) which were computed are displayed on a drop 54.
[0060] In continuing SB6, it is judged whether it is in abnormality within the limits to which U-time (R) and U-time (L) which were computed by the right lower extremity pulse wave velocity baPWV (R) computed by said SB3, the left lower extremity pulse wave velocity baPWV (L), and said SB4, %MAP (R) computed by the above SB 5, and %MAP (L) were beforehand set about each. That is, about the right lower extremity pulse wave velocity baPWV (R) and the left lower extremity pulse wave velocity baPWV (L), it is judged whether it is outside a normal range determined by said SB2, it is judged about U-time (R) and U-time (L) whether they are 180 or more msecs, and it is judged [MAP / %/ % MAP (R) and / (L)] whether it is 42% or less. And when at least one of them is in abnormality within the limits, decision of SB6 is affirmed. Since it is suspected that a constriction is in an artery of lower extremity when decision of this SB6 is affirmed, an ABI measurement routine of drawing 8 is performed. On the other hand, when decision of SB6 is denied, SB7 equivalent to the difference value calculation means 74 is performed.
[0061] Pulse-wave-velocity difference (absolute value) deltaPWV of the right lower extremity pulse wave velocity baPWV (R) and the left lower extremity pulse wave velocity baPWV (L) which were computed by said SB3 in SB7, Difference delta%MAP (absolute value) of difference deltaU-time (absolute value) of U-time (R) and U-time (L) which were computed by said SB4, and %MAP (R) and %MAP (L) computed by said SB5 is computed as a difference value.
[0062] deltaPWV computed by the above SB 7 in continuing SB8, deltaU-time, It is judged whether delta%MAP is beyond the reference value beforehand set up about each. And these deltaPWV, deltaU-time, When at least one of delta%MAP is beyond a reference value, decision of SB8 is affirmed. Since misgiving of a constriction is in an artery of lower extremity of one of membrum inferius when decision of this SB8 is affirmed, an ABI measurement routine of drawing 8 is performed and ABI of both membrum inferius is measured. Thus, since an ABI measurement routine is performed when decision of SB6 or SB8 is affirmed, SB6 and SB8 are equivalent to the ABI measurement starting means 78.
[0063] On the other hand, when decision of SB8 is denied, SB9 is performed continuously. In SB9, it is judged whether the overarm highest-blood-pressure value BPASYS determined by SA9 of drawing 6 is smaller than 100mmHg(s) beforehand set up as the minimum value. When this decision is affirmed, an ankle blood-pressure-measurement routine of drawing 9 is performed. Therefore, SB9 is equivalent to the membrum-inferius blood-pressure-measurement starting means 80. On the other hand, when decision of SB9 is denied, this routine is terminated, without judging that there is no misgiving of a constriction in an artery of lower extremity, and also performing an ABI measurement routine and ankle blood-pressure-measurement routine. Thus, since it is judged whether misgiving of a constriction is in an artery of lower extremity by SB6, SB8, and SB9, SB6, SB8, and SB9 are equivalent also to the preliminary judging means 76.
[0064] Then, an ABI measurement routine of drawing 8 is explained. By ABI measurement routine of drawing 8 , SC1 thru/or SC3 equivalent to the cuff pressure control means 60 is performed first. The pressure regulating valves 26a and 26b connected to two cuffs 20R and 20L for overarms in SC1, respectively, And the pressure regulating valves 26c or 26d connected to the cuff 18 (it is the cuff 18 for ankles of both sides when judged with there being misgiving of a constriction in SB8) for ankles of a side judged as there being misgiving of a constriction by SB6 or SB8 of drawing 7 are switched to a pressure supply condition. And when an air pump 36 drives, rapid pressure up of two cuffs 20R and 20L for overarms and one [at least] cuff 18 for ankles is started. In continuing SC2, it is judged about each cuff pressure PC whether it became more than the aim compression pressure PCM (about 180mmHg(s) and the cuff 18 for ankles, they are [cuff / 20 / for overarms] 240mmHg(s)) to which cuff pressure PC of those cuffs 18 and 20 was set beforehand, respectively. When decision of this SC2 is denied, lifting of cuff pressure PC is continued by carrying out repeat activation of one or less above SC.
[0065] And if decision of the above SC 2 is affirmed by lifting of cuff pressure PC, at continuing SC3, it will change to a **** exhaust-gas-pressure condition sequentially from the pressure regulating valve 26 connected to the cuffs 18 and 20 which reached the aim compression pressure PCM, and will be dropped at the cuff 18 connected to the pressure regulating valve 26, and a loose speed which is a 5 mmHg/sec degree as which a pressure in 20 was determined beforehand. And if decision of SC2 is affirmed about all cuff pressure PCs, an air pump 36 will also be suspended.
[0066] Next, a blood-pressure value decision routine of SC4 equivalent to the overarm blood-pressure value decision

means 72 and the ankle blood-pressure value decision means 82 is performed. That is, amplitude of the overarm pulse wave WA which the pulse wave signal SM serially supplied from the pulse wave discriminator 32 expresses, or the ankle pulse wave WL is determined for every beat, and the right upper arm highest-blood-pressure value BPASYS(R) left upper arm highest-blood-pressure value BPASYS (L), the right (left) ankle highest-blood-pressure value BPLSYS, etc. are determined according to blood-pressure value decision algorithm of an oscillograph metric method known well based on change of the amplitude.

[0067] Next, the inside of a cuff 18 and 20 is made to carry out exhaust gas pressure quickly in SC5 equivalent to the cuff pressure control means 60 by switching the pressure regulating valve 26 which suited a **** exhaust-gas-pressure condition to a rapid exhaust-gas-pressure condition.

[0068] Then, SC6 equivalent to the ankle overarm blood-pressure characteristic calculation means 84 is performed. In SC6, by being broken by value of the higher one of the right upper arm highest-blood-pressure value BPASYS (R) as which the right ankle highest-blood-pressure value BPLSYS (R) determined by SC4 or the left ankle highest-blood-pressure value BPLSYS (L) was determined by SC4, and the left upper arm highest-blood-pressure values BPASYS (L), ABIR or ABIL is computed and the computed ABIR or ABIL is displayed on a drop 54.

[0069] Then, an ankle blood-pressure-measurement routine of drawing 9 is explained. By ankle blood-pressure-measurement routine of drawing 9 , SD1 thru/or SD3 equivalent to the cuff pressure control means 60 is performed first. In SD1, when the pressure regulating valves 26c or 26d connected to the cuff 18 for ankles of a side judged as there being misgiving of a constriction by SB9 of drawing 7 are switched to a pressure supply condition and an air pump 36 drives, rapid pressure up of one [at least] cuff 18 for ankles is started. In continuing SD2, it is judged whether it became more than the aim compression pressure PCM (for example, 240mmHg(s)) to which cuff pressure PC of the cuff 18 was set beforehand. When decision of this SD2 is denied, lifting of cuff pressure PC is continued by carrying out repeat activation of one or less above SD.

[0070] And if decision of the above SD 2 is affirmed by lifting of cuff pressure PC, at continuing SD3, while an air pump 36 is stopped, a pressure regulating valve 26 will be changed to a **** exhaust-gas-pressure condition, and it will be dropped at a loose speed which is a 5 mmHg/sec degree as which a pressure in a cuff 18 was determined beforehand.

[0071] Next, a blood-pressure value decision routine of SD4 equivalent to the ankle blood-pressure value decision means 82 is performed. That is, amplitude of the ankle pulse wave WL which the pulse wave signal SM serially supplied from the pulse wave discriminator 32 expresses is determined for every beat, and the right (left) ankle highest-blood-pressure value BPLSYS, the right (left) ankle lowest-blood-pressure value BPLDIA, and the right (left) ankle mean-blood-pressure value BPLMEAN are determined according to blood-pressure value decision algorithm of an oscillograph metric method known well based on change of the amplitude.

[0072] Next, the inside of a cuff 18 is made to carry out exhaust gas pressure quickly by switching a pressure regulating valve 26 to a rapid exhaust-gas-pressure condition in SD5 equivalent to the cuff pressure control means 60.

[0073] In continuing SD6, the right (left) ankle highest-blood-pressure value BPLSYS determined by SD4 is displayed on a drop 54.

[0074] In the example based on an above-mentioned flow chart, it sets in advance of measurement of the ankle blood-pressure value BQL by ankle blood-pressure-measurement equipment 42 to SB3, SB4, and SB5 (constriction related pulse wave information decision means). The membrum-inferius pulse wave velocity baPWV, U-time, and %MAP are determined from the ankle pulse wave WL extracted by the pulse wave discriminators 32c and 32d. And since these membrum-inferius pulse wave velocity baPWV, U-time, and %MAP are displayed on a drop 54 In order to compute ABI, it becomes unnecessary to perform blood pressure measurement by ankle blood-pressure-measurement equipment 42, when it can be judged from these membrum-inferius pulse wave velocity baPWV, U-time, and %MAP that there is no misgiving of a constriction of an artery of lower extremity. Therefore, pain of a patient at the time of diagnosing a constriction of an artery of lower extremity decreases.

[0075] Moreover, in the example based on an above-mentioned flow chart, when judged with there being misgiving of a constriction by SB6 and SB9 (preliminary judging means 76), blood pressure measurement by ankle blood-pressure-measurement equipment 42 and overarm blood-pressure-measurement equipment 40 is performed automatically, and there is an advantage by which ABI is computed.

[0076] Moreover, in the example based on an above-mentioned flow chart, a normal range of the membrum-inferius pulse wave velocity baPWV is determined from relation of drawing 4 in SB2 (normal-range decision means 70) based on the upper extremity pulse wave velocity hbPWV. And in SB6 (preliminary judging means 76), it is judged with misgiving of a constriction being in an artery of lower extremity based on the membrum-inferius pulse wave velocity baPWV computed in SB3 (membrum-inferius pulse-wave-velocity information calculation means 68) being outside a normal range. Since the above-mentioned normal range is determined based on the upper extremity pulse wave velocity

hbPWV actually measured for every measurement, as compared with a case where misgiving of a constriction of an artery of lower extremity is judged based on whether it is in a general normal range set up so that the measured membrum-inferius pulse wave velocity baPWV might be applied to many patients actually, preliminary decision of existence of a constriction in an artery of lower extremity can perform it with a more sufficient precision.
[0077] moreover, in the example based on an above-mentioned flow chart The left lower extremity pulse wave velocity baPWV (L), U-time (L) based on the left lower extremity pulse wave WLL, % The right lower extremity pulse wave velocity baPWV based on MAP (L) and the right lower extremity pulse wave WLR (R) When at least one of the difference values (deltaPWV, deltaU-time, delta%MAP) with U-time (R) and %MAP (R) is beyond a reference value In SB8 (preliminary judging means 76), since it is judged with there being misgiving of a constriction, preliminary decision of existence of a constriction in an artery of lower extremity can carry out with a more sufficient precision.
[0078] As mentioned above, although one example of this invention was explained based on a drawing, this invention is applied also in other modes.
[0079] For example, although the abnormality range of the membrum-inferius pulse wave velocity baPWV was determined for every patient with an operation gestalt mentioned above by deciding that they will be ranges other than a normal range determined by the normal-range decision means 70, the abnormality range of the membrum-inferius pulse wave velocity baPWV may be the constant value set up beforehand. On the contrary, with an operation gestalt mentioned above, although the abnormality range of U-time and %MAP was determined beforehand, it may determine the abnormality range of U-time in membrum inferius, or %MAP for every patient based on U-time and %MAP which measured U-time or %MAP in an overarm, and were measured in the overarm like [in the case of the membrum-inferius pulse wave velocity baPWV].
[0080] Moreover, when the preliminary judging means 76 had the misgiving of a constriction in an artery of lower extremity with an operation gestalt mentioned above, blood pressure measurement by ankle blood-pressure-measurement equipment 42 and/or overarm blood-pressure-measurement equipment 40 was performed automatically, but when judged with misgiving of a constriction being in an artery of lower extremity, it is good to even display an alphabetic character or a mark which only shows that on a drop 54. Moreover, since it can judge whether an operator needs to measure a membrum-inferius upper extremity blood-pressure characteristic from the content of a display like an example based on the above-mentioned flow chart when constriction related pulse wave information (baPWV, U-time, %MAP) is displayed on a drop 54, the preliminary judging means 76 does not need to be established in that case.
[0081] Moreover, independently [the pulse wave discriminator 32 of these blood-pressure-measurement equipments 40 and 42], although the pulse wave discriminator 32 with which overarm blood-pressure-measurement equipment 40 was equipped functioned also as upper extremity pulse wave detection equipment and the pulse wave discriminator 32 with which ankle blood-pressure-measurement equipment 42 was equipped was functioning also as membrum-inferius pulse wave detection equipment with an operation gestalt mentioned above, only in order to detect a pulse wave, an upper extremity or membrum inferius may be equipped with pulse wave detection equipment. A photoelectrical pulse wave sensor with which the finger tip section etc. is equipped for an impedance pulse wave sensor which detects impedances which press predetermined arteries, such as a photoelectrical pulse wave detection probe for oxymetries and a radial artery, from epidermis, and detect a pressure pulse wave as pulse wave detection equipment, for example, such as a pressure pulse wave sensor of format, an arm, and a fingertip, through an electrode, pulse detection, etc. can be used.
[0082] Moreover, although an operation gestalt mentioned above explained an example which computes overarm pulse-wave-velocity information between the heartbeat microphone 44 and the cuff 20 for overarms, overarm pulse-wave-velocity information between other 2 parts may be computed. For example, since the heart is not located on a living body center line, the cuffs 20 for overarms wound around the overarm 14 on either side differ in distance from the heart. Then, overarm pulse-wave-velocity information may be computed from time difference of the overarm pulse waves WAR and WAL generated in the cuff 20 for overarms on either side. Or the finger tip section of an arm may be equipped with a photoelectrical pulse wave sensor, and overarm pulse-wave-velocity information may be computed between the heart (or overarm) and a fingertip.
[0083] Moreover, although an operation gestalt mentioned above explained an example which computes membrum-inferius pulse-wave-velocity information between the cuff 18 for ankles, and the cuff 20 for overarms, membrum-inferius pulse-wave-velocity information between the heartbeat microphone 44 and the cuff 18 for ankles may be computed.
[0084] As mentioned above, although an operation gestalt of this invention was explained to details based on a drawing, this is 1 operation gestalt to the last, and this invention can be carried out in a mode which added various modification and amelioration based on this contractor's information.

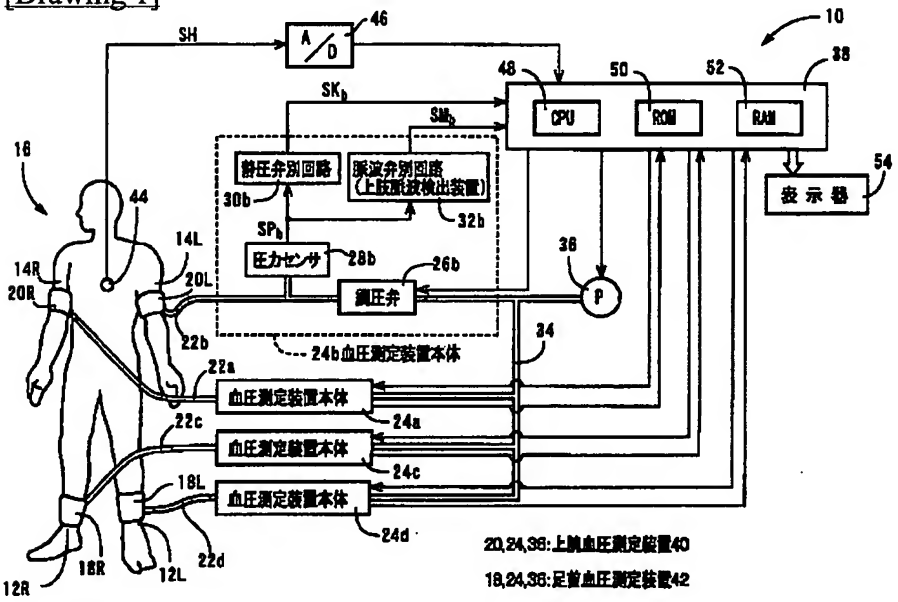
[Translation done.]

* NOTICES *

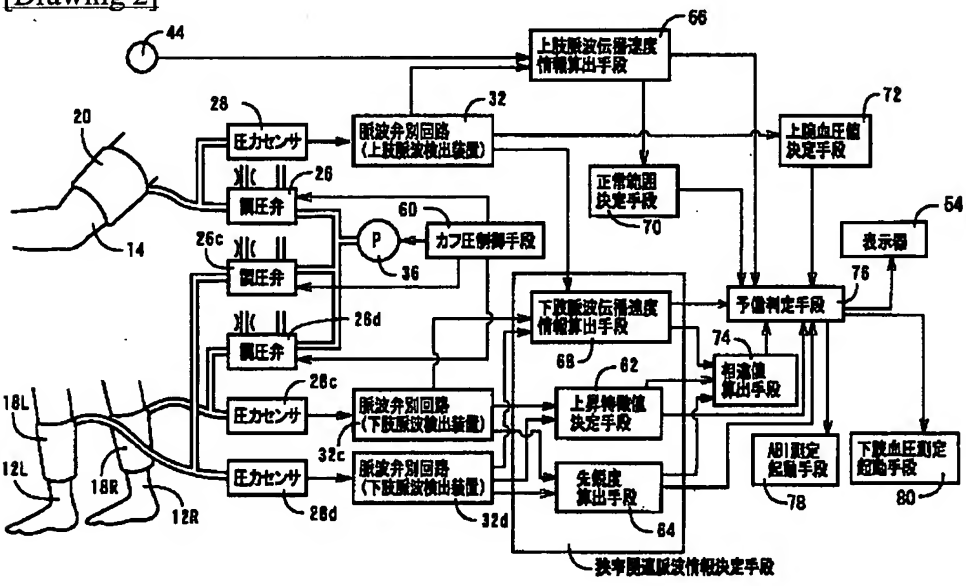
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

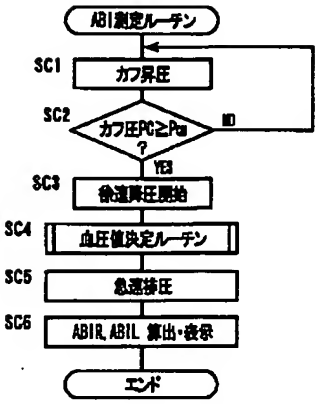
[Drawing 1]



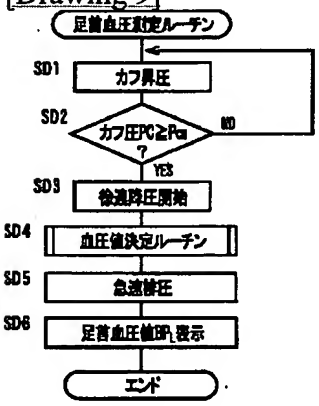
[Drawing 2]



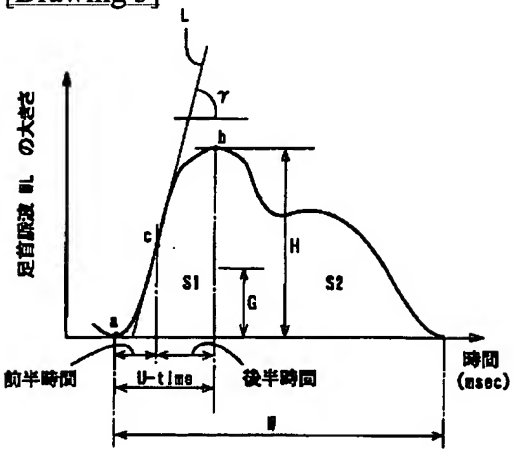
[Drawing 8]



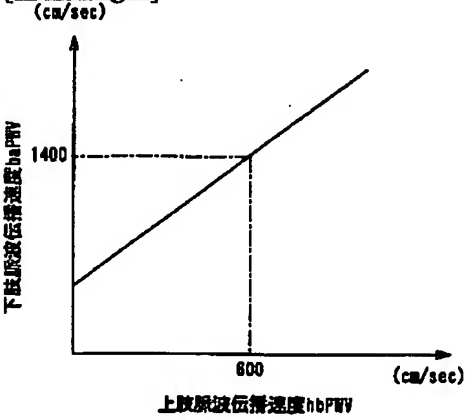
[Drawing 9]



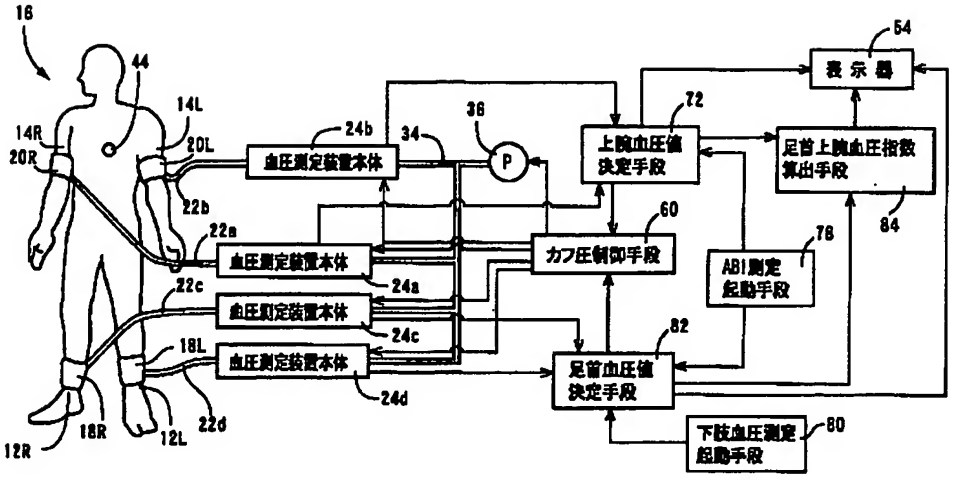
[Drawing 3]



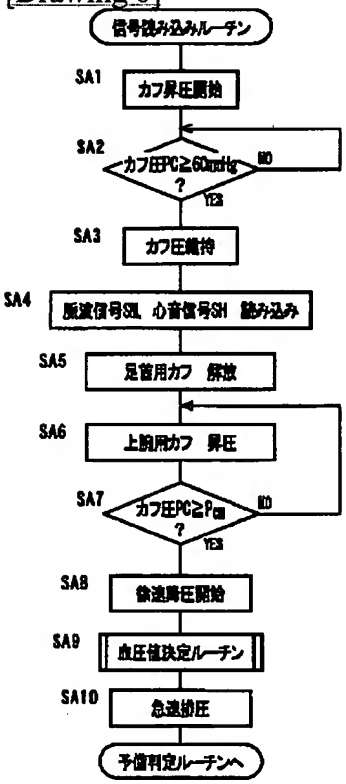
[Drawing 4]



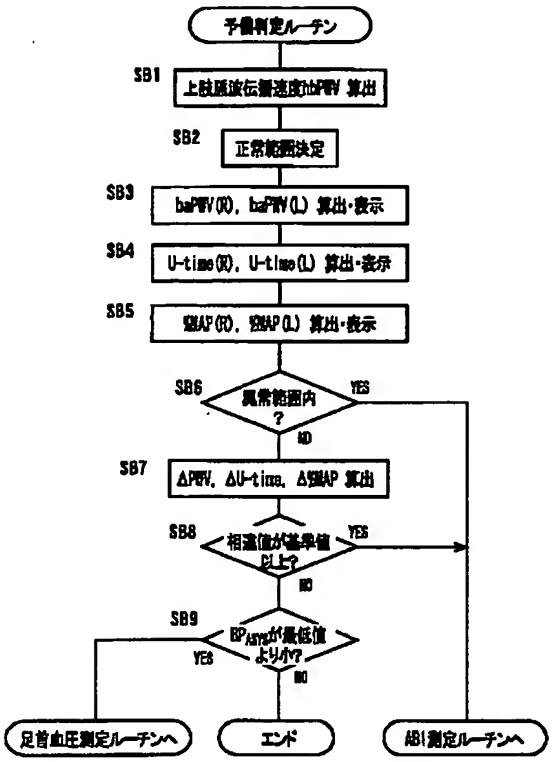
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]